



# 20% Wind Energy by 2030

## Michigan Wind Working Group

**Host: John Sarver, Michigan Wind Working Group**

**Presenter: Jeff Anthony,  
American Wind Energy Association**

**August 14, 2008**

**The Webcast will begin soon, please dial this number  
and access code for the audio portion of the webcast:**

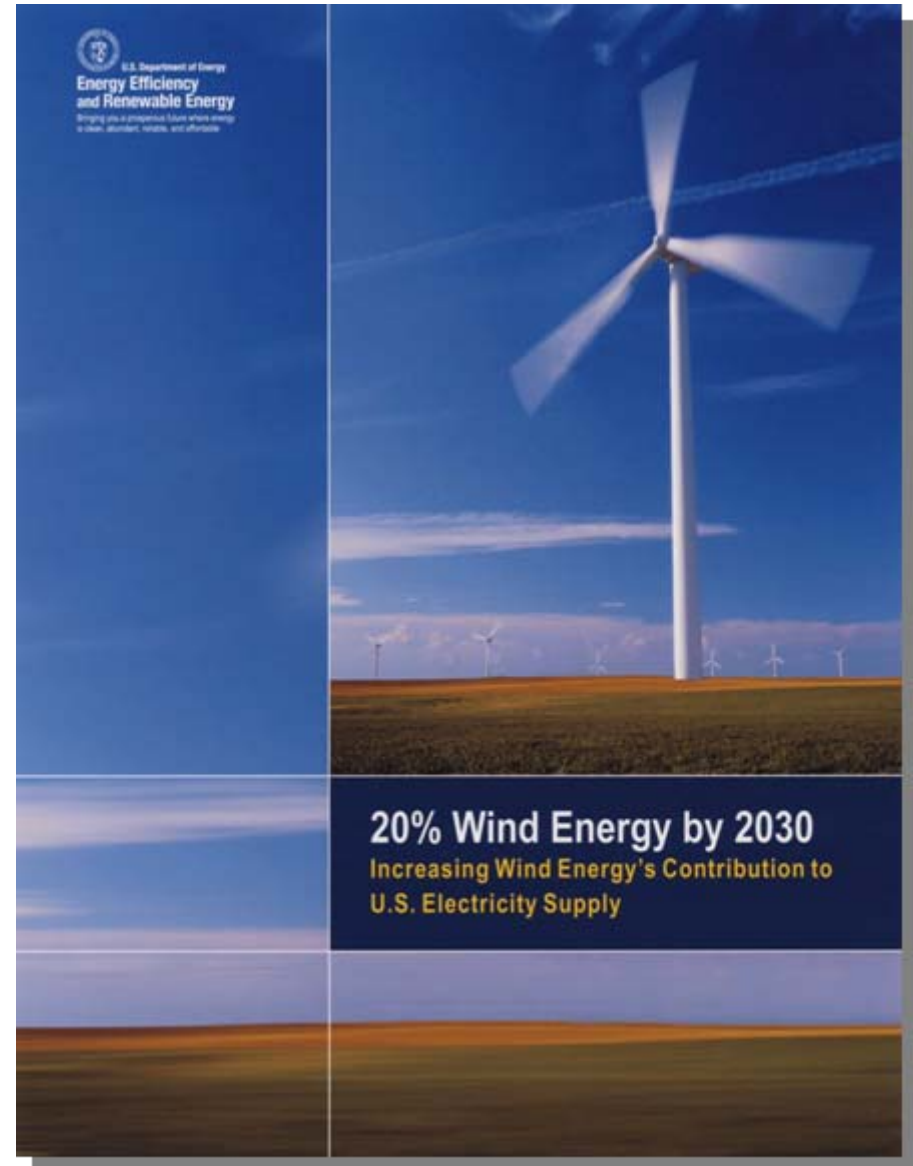
**Dial: 866-757-3679    Access code: 546737#**

20% Wind Energy  
by 2030



# Presentation and Objectives Overview

- ▶ Background
- ▶ 20% Wind Scenario
- ▶ Costs
- ▶ Benefits
- ▶ Challenges
- ▶ Summary





# The 20% Technical Report

- ✦ Explores one scenario for reaching 20% wind energy by 2030 and contrasts it to a scenario in which no new U.S. wind power capacity is installed
- ✦ Is not a prediction, but an analysis based on one scenario
- ✦ Does not assume specific policy support for wind
- ✦ Is the work of more than 100 individuals involved from 2006 - 2008 (government, industry, utilities, NGOs)
- ✦ Analyzes wind's potential contributions to energy security, economic prosperity and environmental sustainability

# The 20% Wind Scenario





# The 20% Wind Energy Scenario

## ▲ Primary Assumptions:

- U.S. electricity consumption grows 39% from 2005 to 2030 -- to 5.8 billion MWh (Source: EIA)
- Wind turbine energy production increases about 15% by 2030
- Wind turbine costs decrease about 10% by 2030
- No major breakthroughs in wind technology

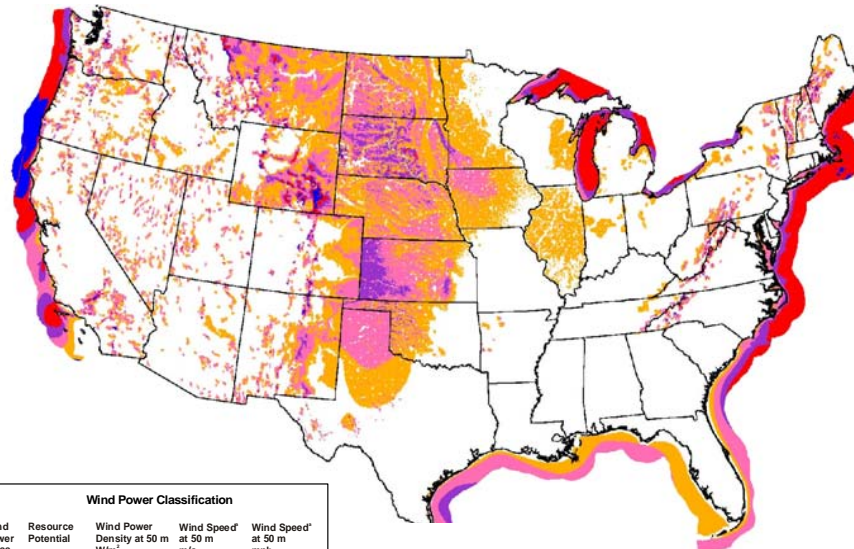
## ▲ Primary Findings:

- 20% wind electricity would require about 300 GW (300,000 MW) of wind generation
- An increase of about 285 GW over July 2008 level
- Affordable, accessible wind resources available across the nation



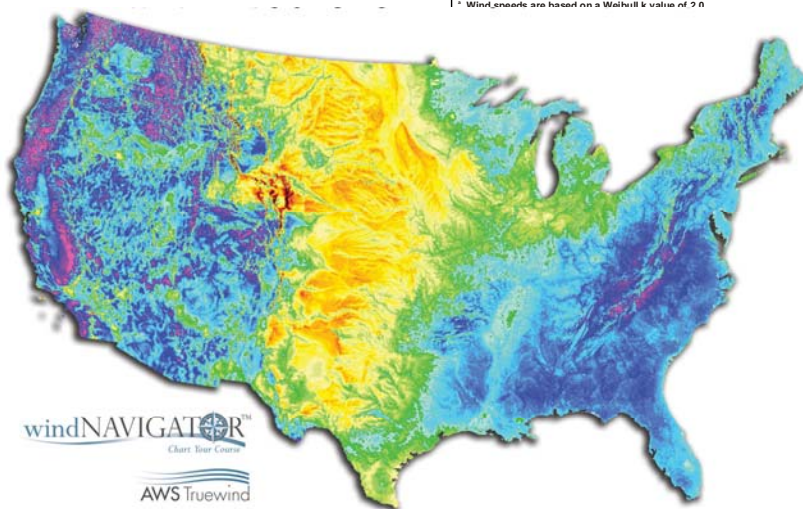


# U.S. Wind Resource Maps



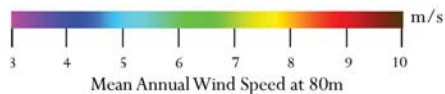
Wind Power Classification				
Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m <sup>2</sup>	Wind Speed* at 50 m m/s	Wind Speed* at 50 m mph
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

\* Wind speeds are based on a Weibull k value of 2.0

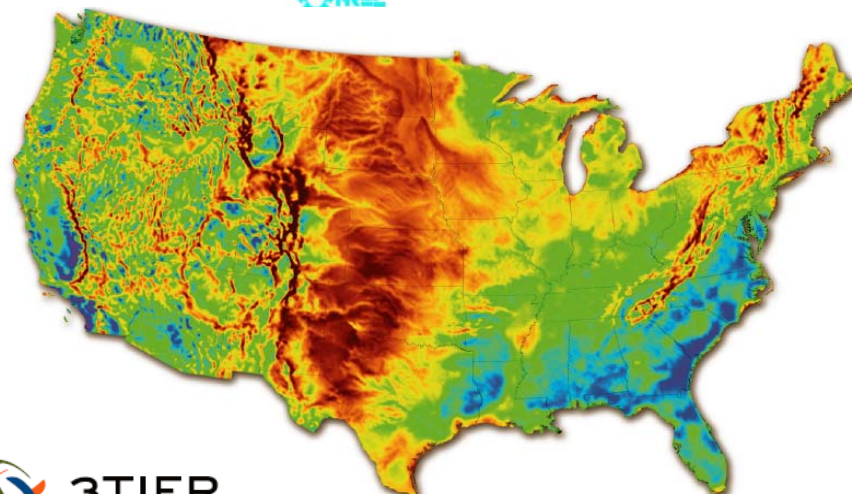


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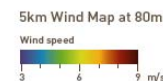


Wind Resource of the United States at 2.5km grid cell resolution.  
SOURCE: Data and image developed by AWS Truewind for windNavigator:  
<http://navigator.aws-truewind.com>



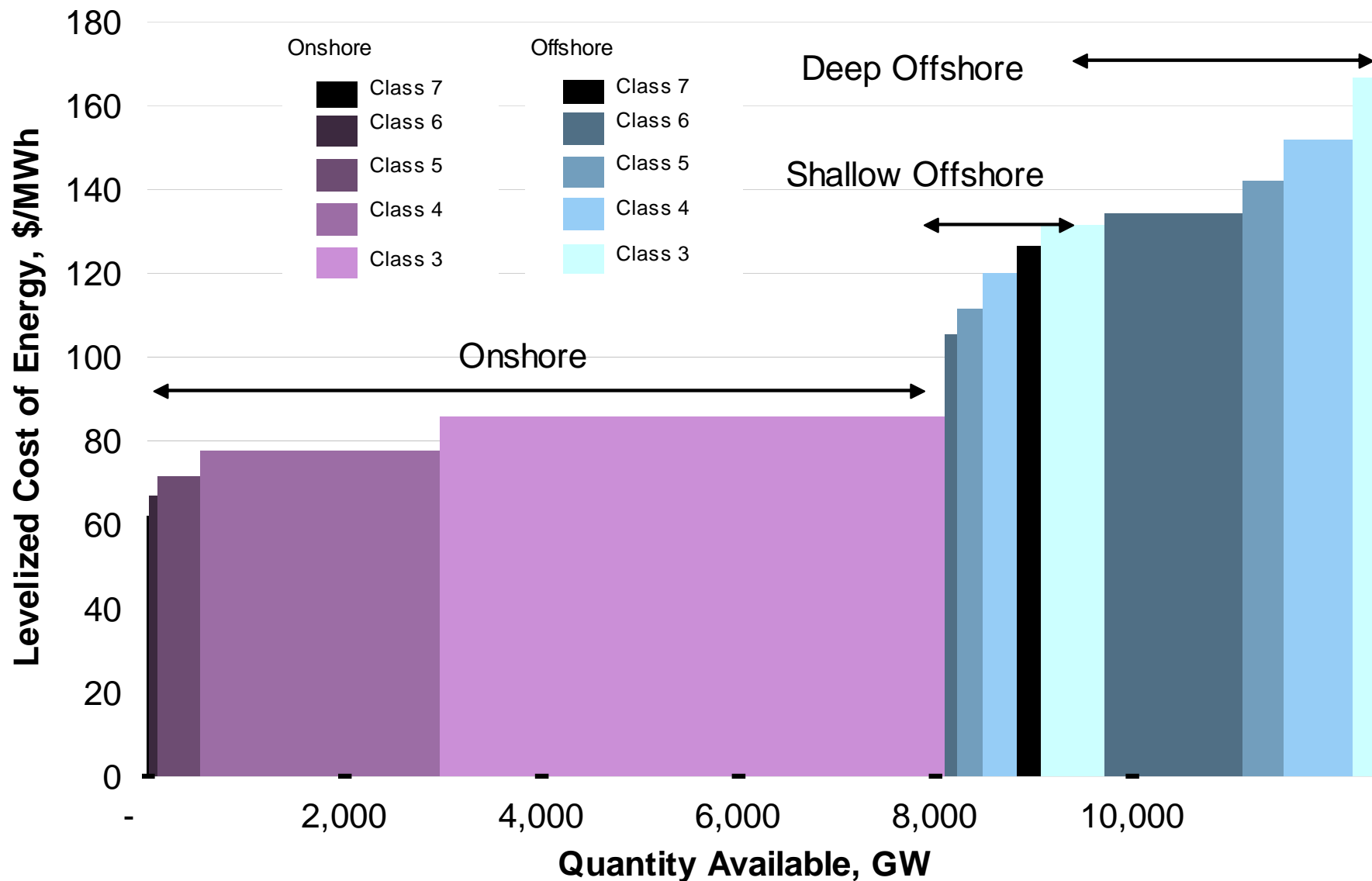
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# Resource Potential Exceeds Total Electricity Demand

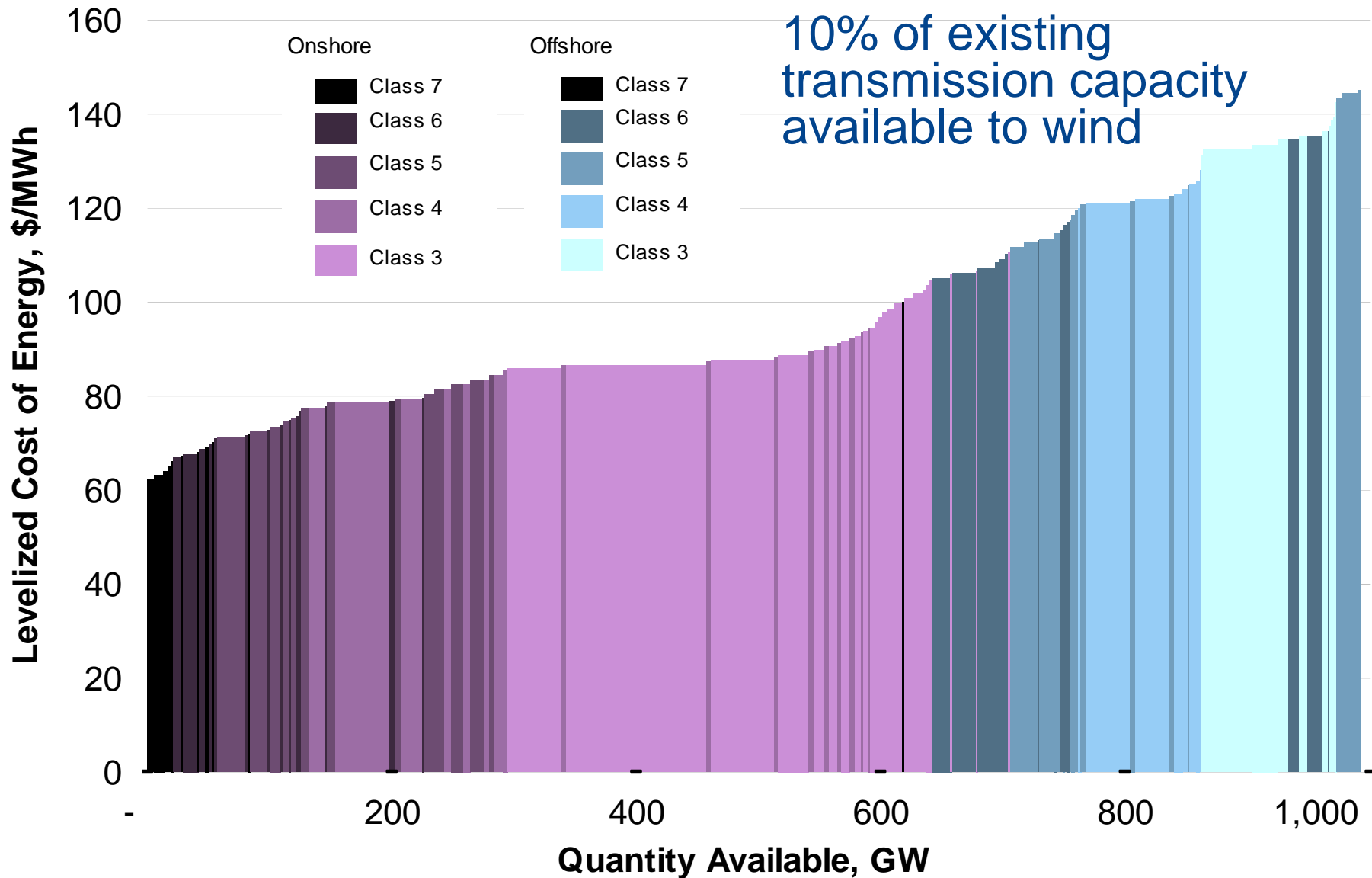


2010 Costs w/o PTC, w/o Transmission or Integration costs





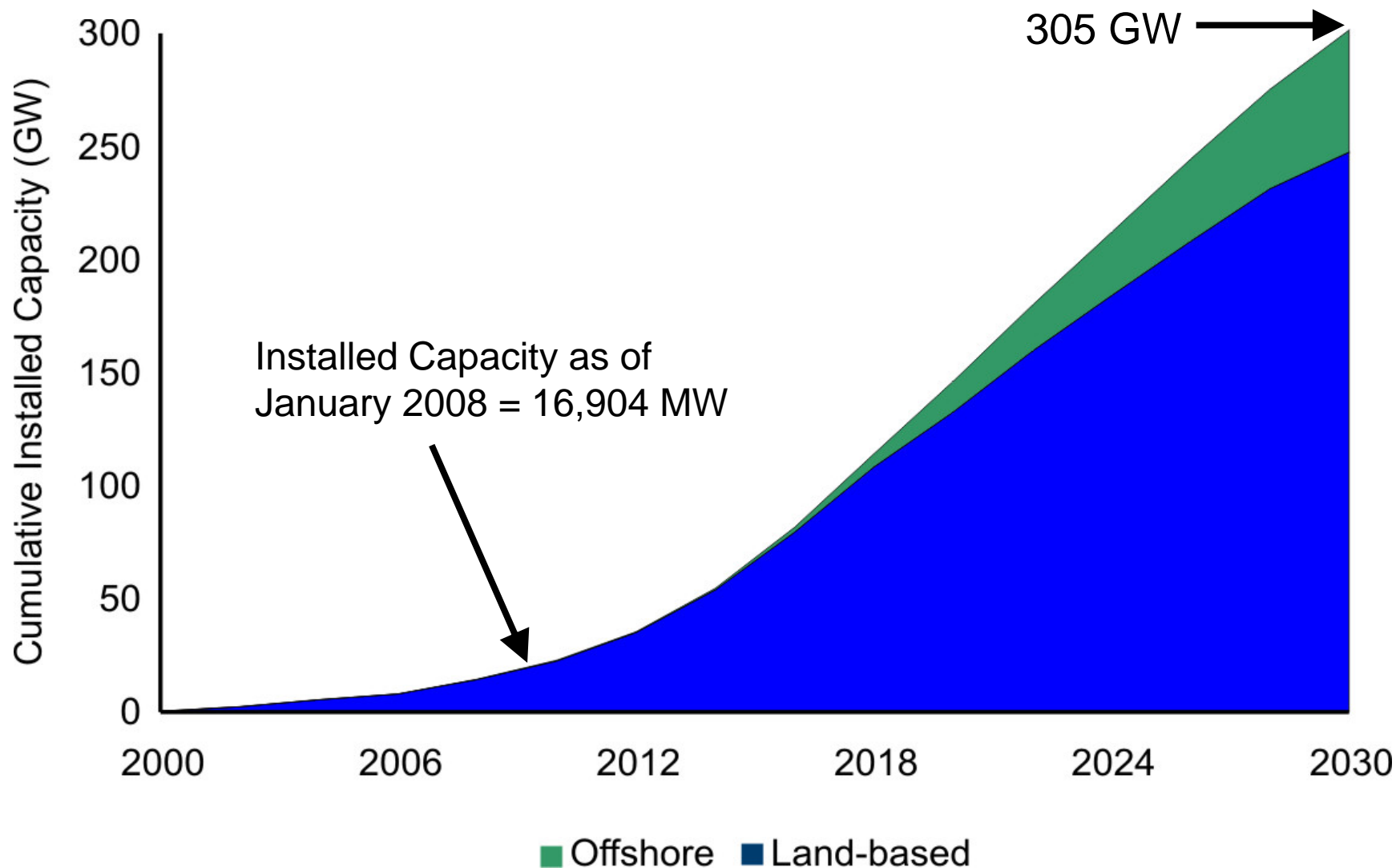
# Cost of Wind and Transmission: Economically Available



2010 Costs w/o PTC, \$1,600/MW-mile, w/o Integration costs

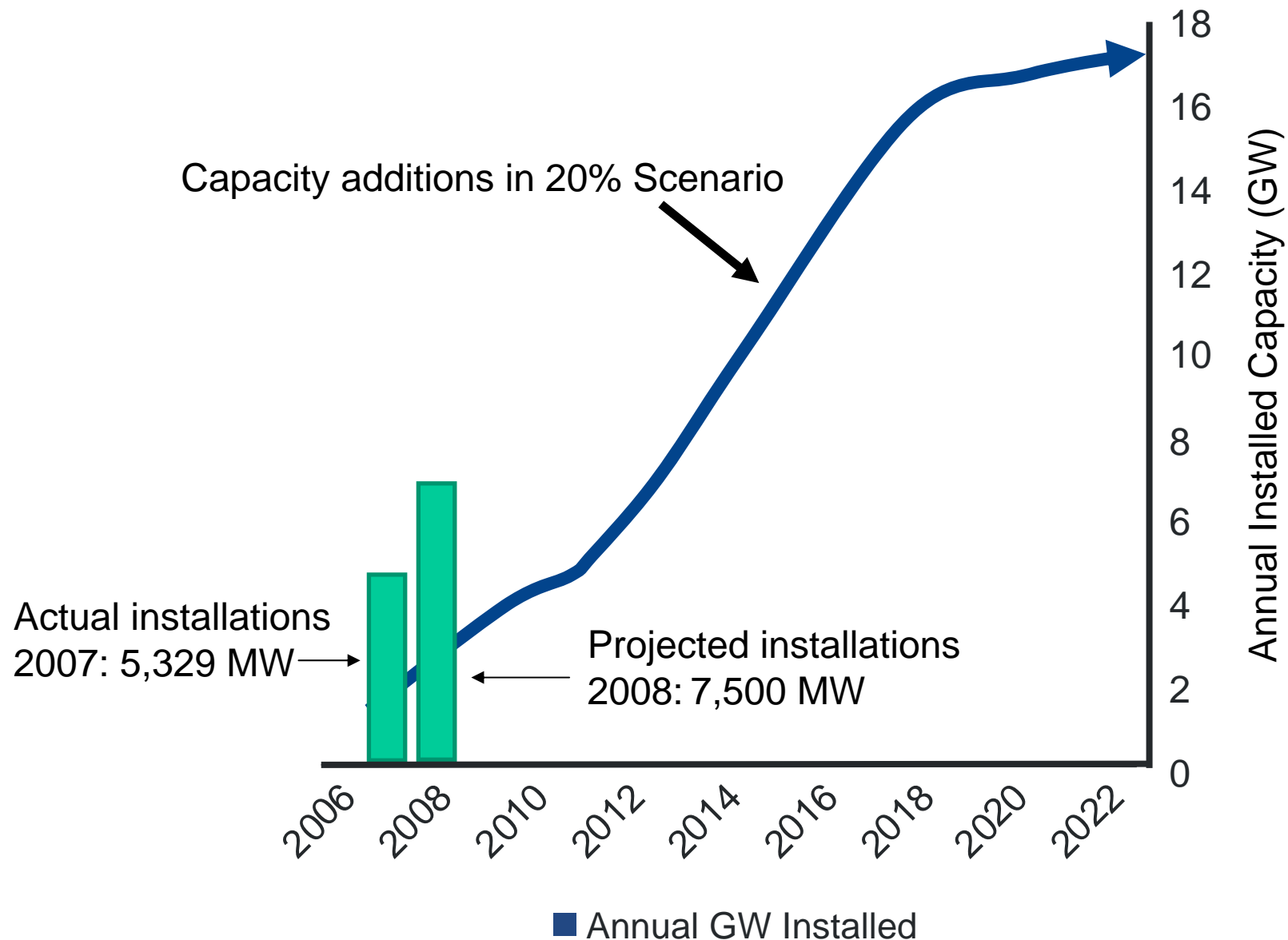


# 20% Wind Scenario



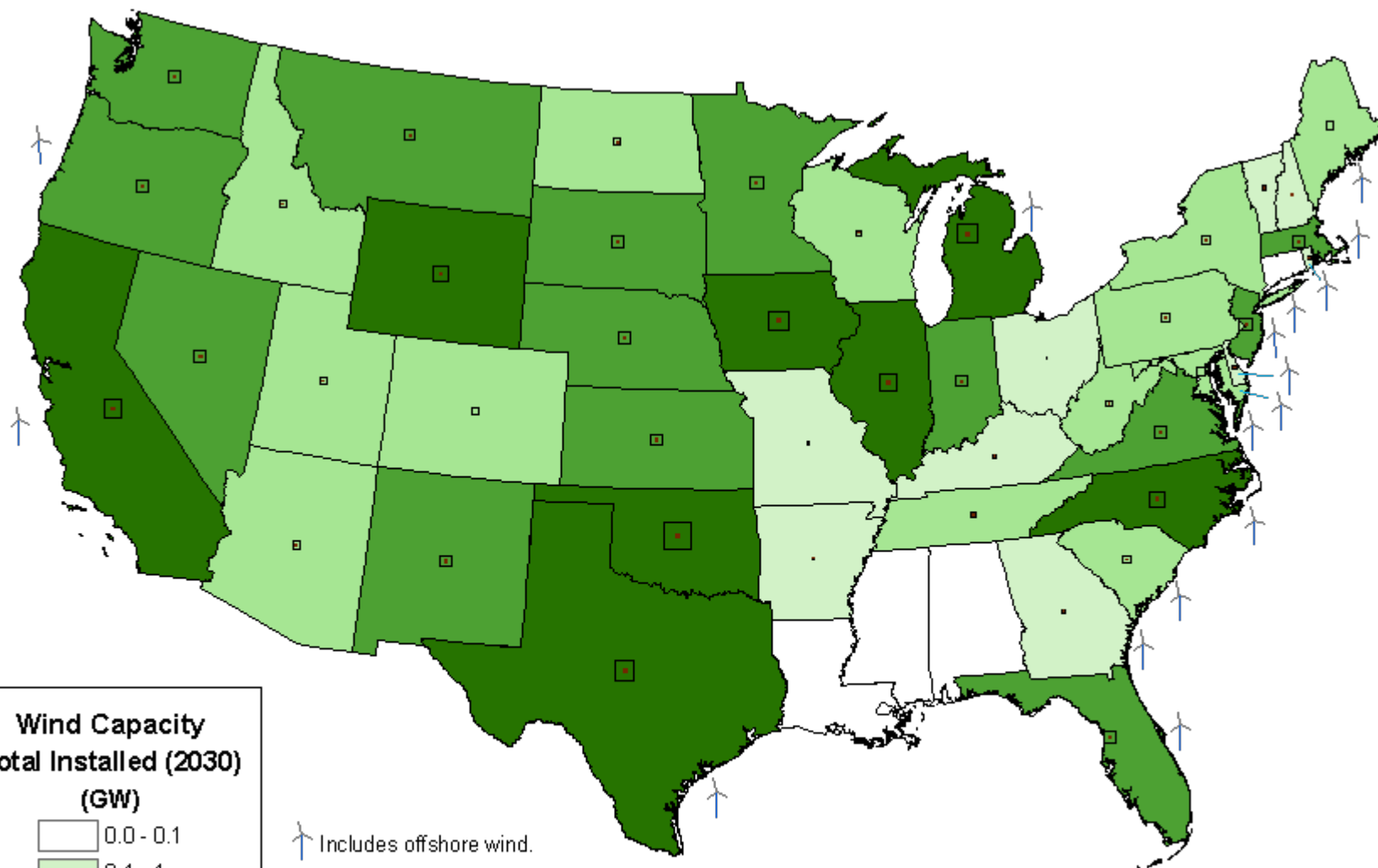


# Annual Installed Capacity vs. Current Installed Capacity

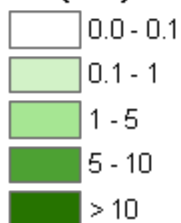




# 46 States Would Have Substantial Wind Development by 2030



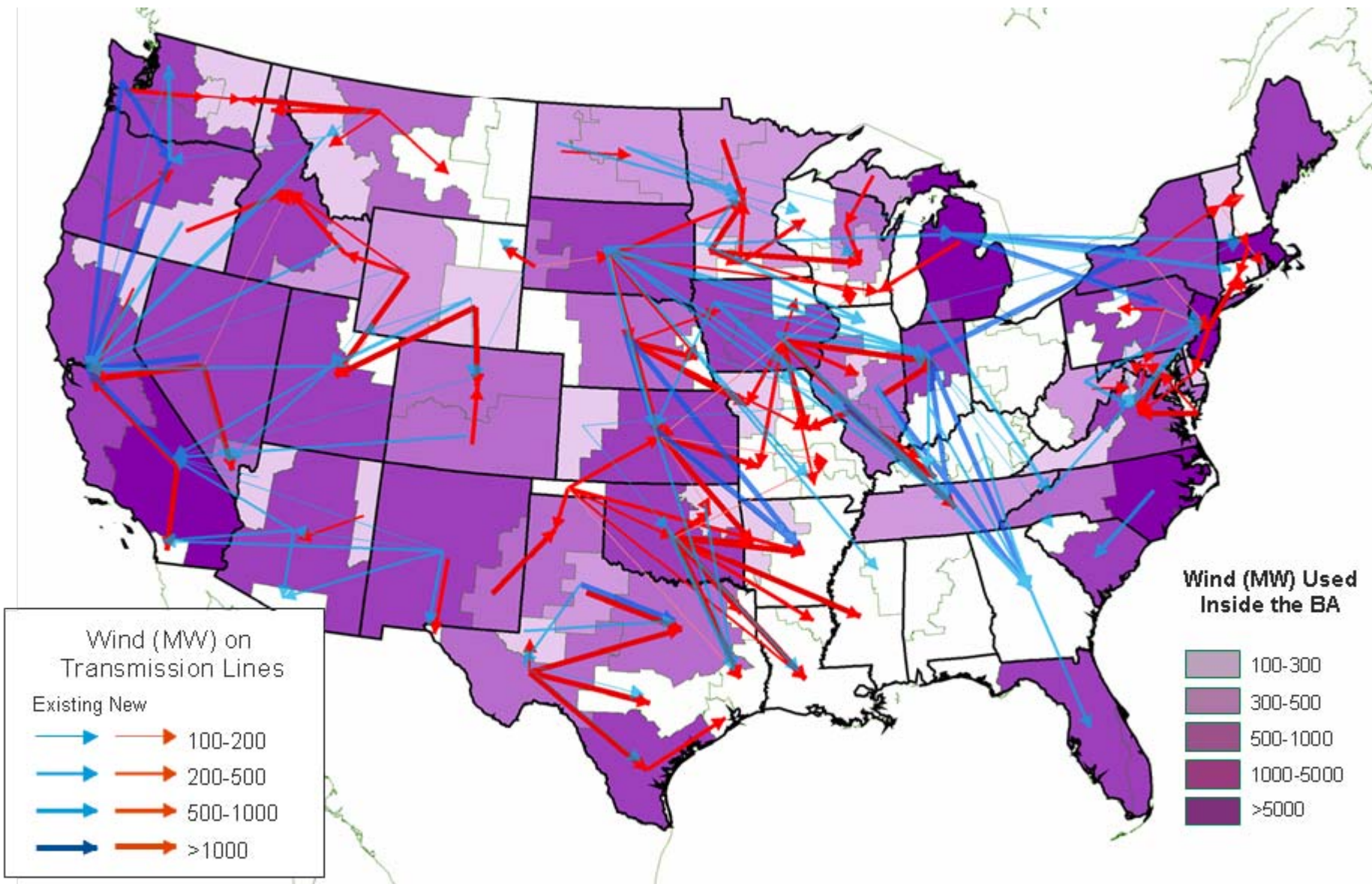
## Wind Capacity Total Installed (2030) (GW)



Includes offshore wind.

The black open square in the center of a state represents the land area needed for a single wind farm to produce the projected installed capacity in that state. The brown square represents the actual land area that would be dedicated to the wind turbines (2% of the black open square).

# Need for New Transmission: Existing and New in 2030





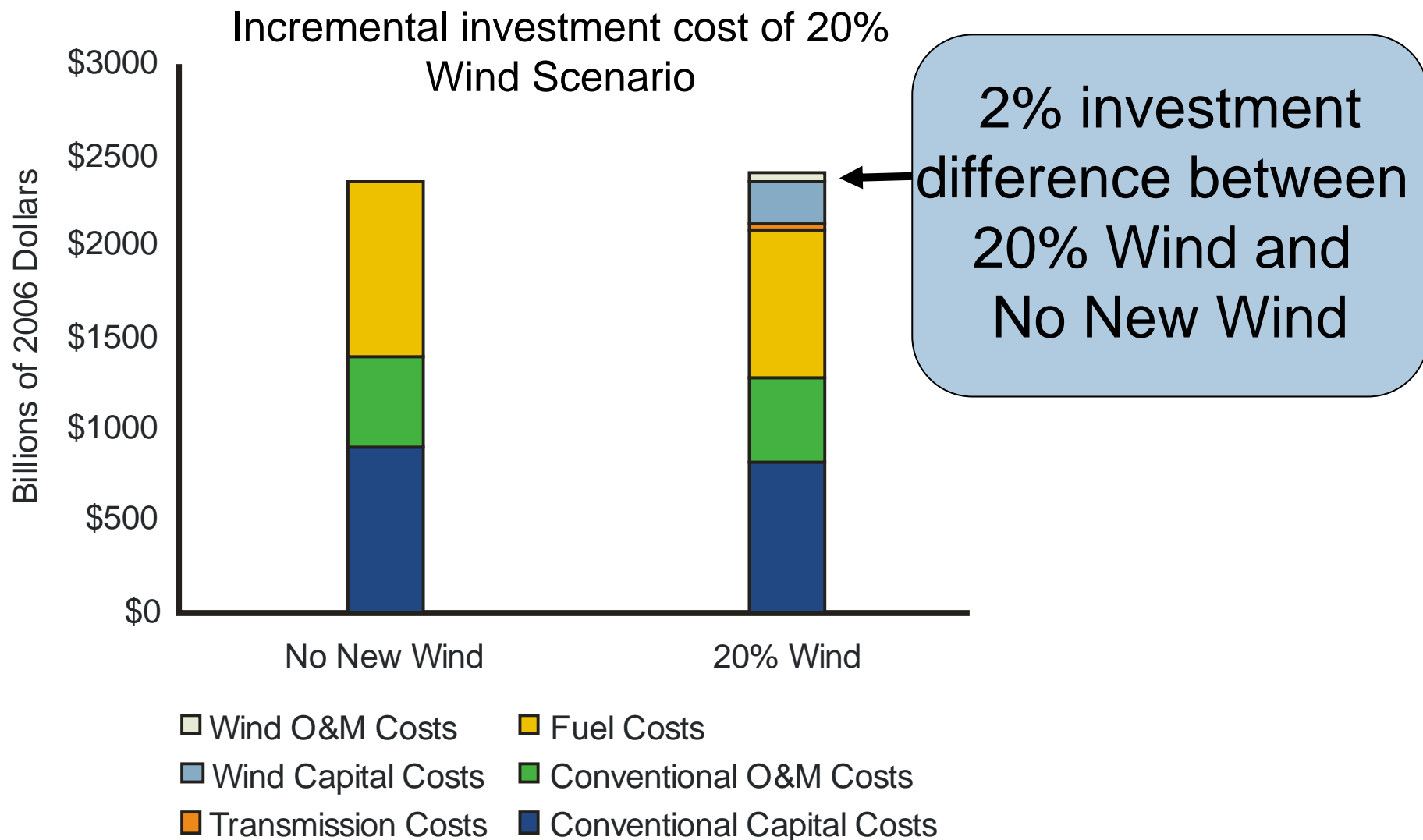
# Costs, Benefits, and Impacts of the 20% Wind Scenario







# Economic Costs of 20% Wind Scenario





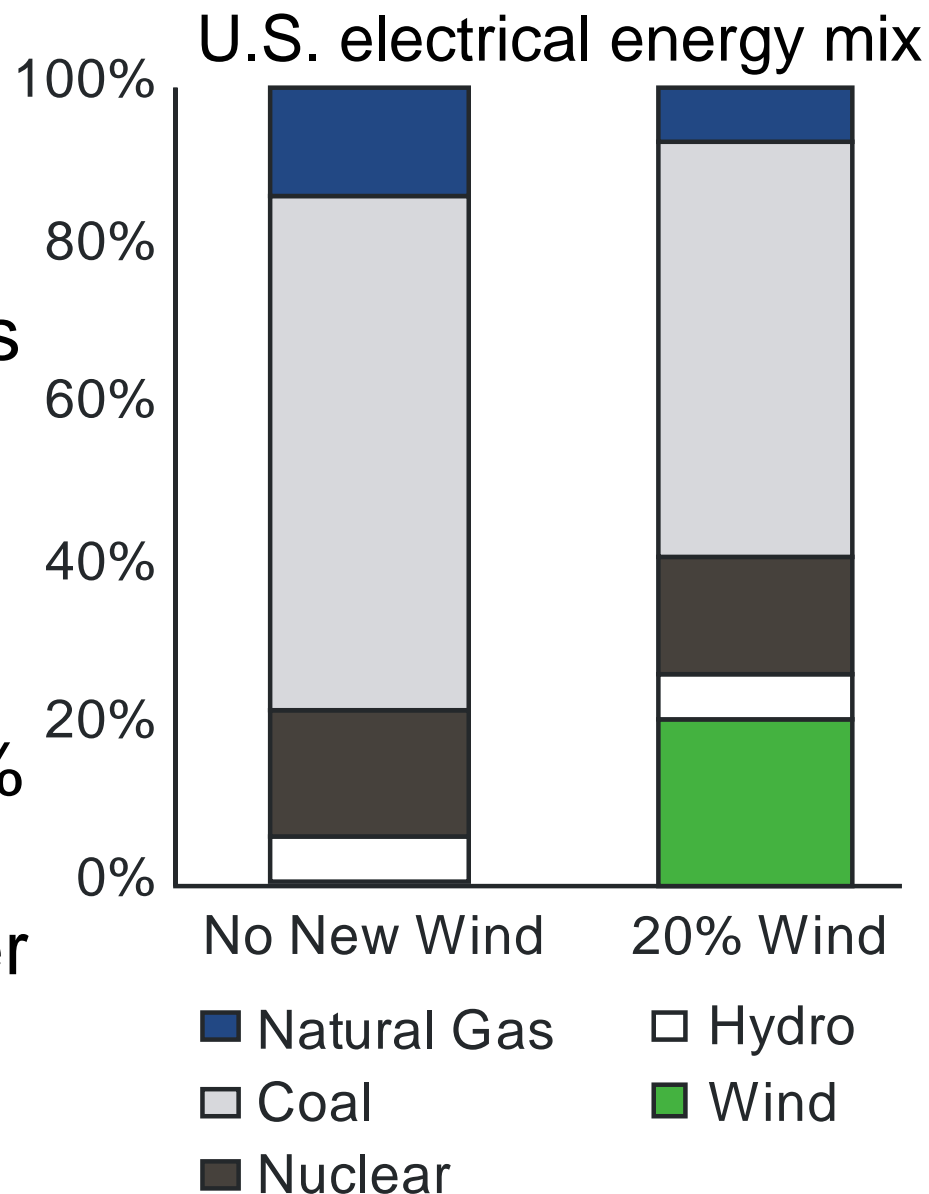
# Electricity Sector Costs

- ✦ Incremental economic costs reflect:
  - Capital costs of wind projects relative to other projects
  - Incremental transmission investment
- ✦ No New Wind scenario costs over \$2 trillion in new investment in net present value terms by 2030
- ✦ 20% Wind Scenario requires only 2% more investment (\$43 billion in net present value)
- ✦ 50 cents per month on average household bill



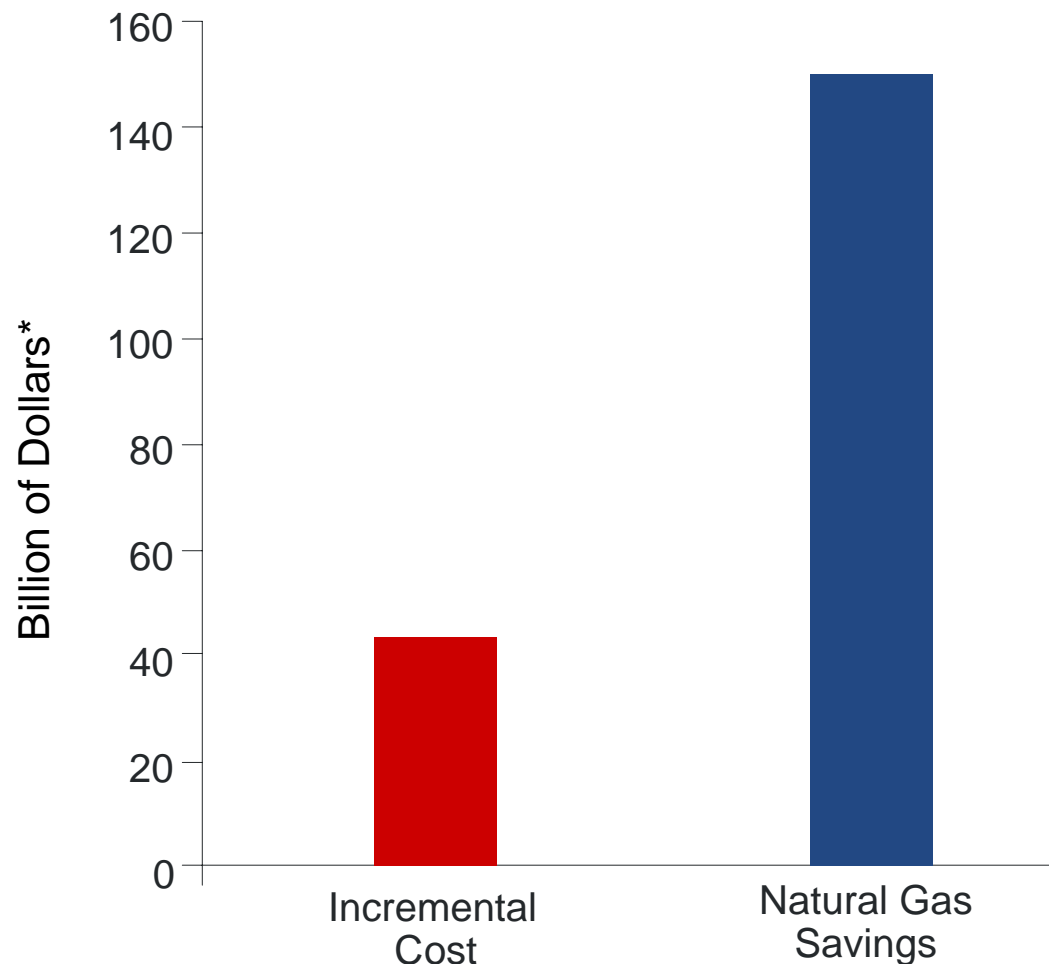
# 20% Wind Scenario Impact on Generation Mix in 2030

- Reduces electric utility natural gas consumption by 50%
- Reduces total natural gas consumption by 11%
- Natural gas consumer benefits: \$86-214 billion\*
- Reduces electric utility coal consumption by 18%
- Avoids construction of 80 GW of new coal power plants





# 20% Wind Cost Increment Compared to Savings from Reduced Natural Gas Price Pressure

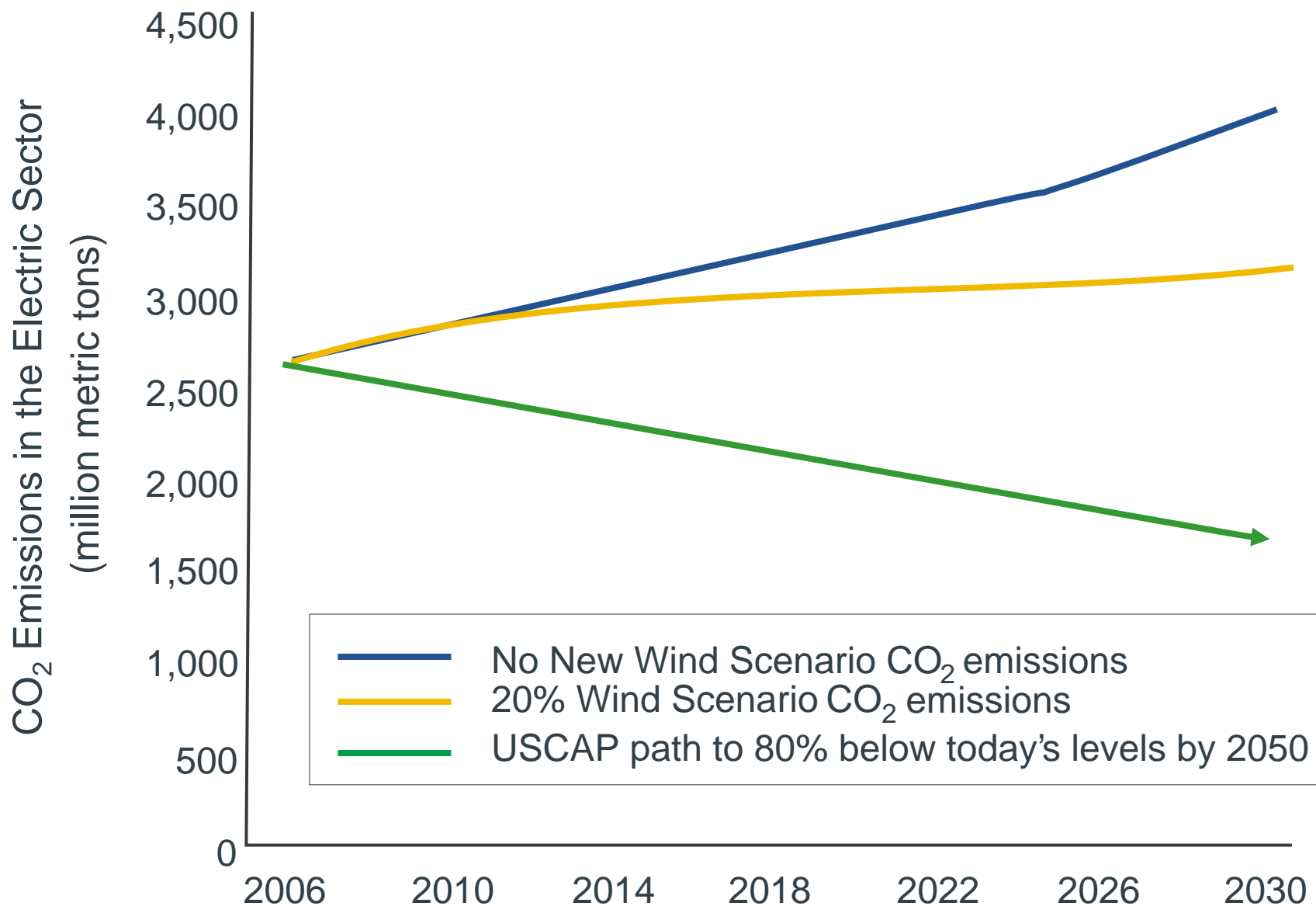


The benefits from reduced pressure on natural gas prices across all gas users would be \$150 billion (NPV), by itself exceeding the incremental cost of investing in the 20% Scenario.

\*NPV



# CO<sub>2</sub> Emissions from the Electricity Sector

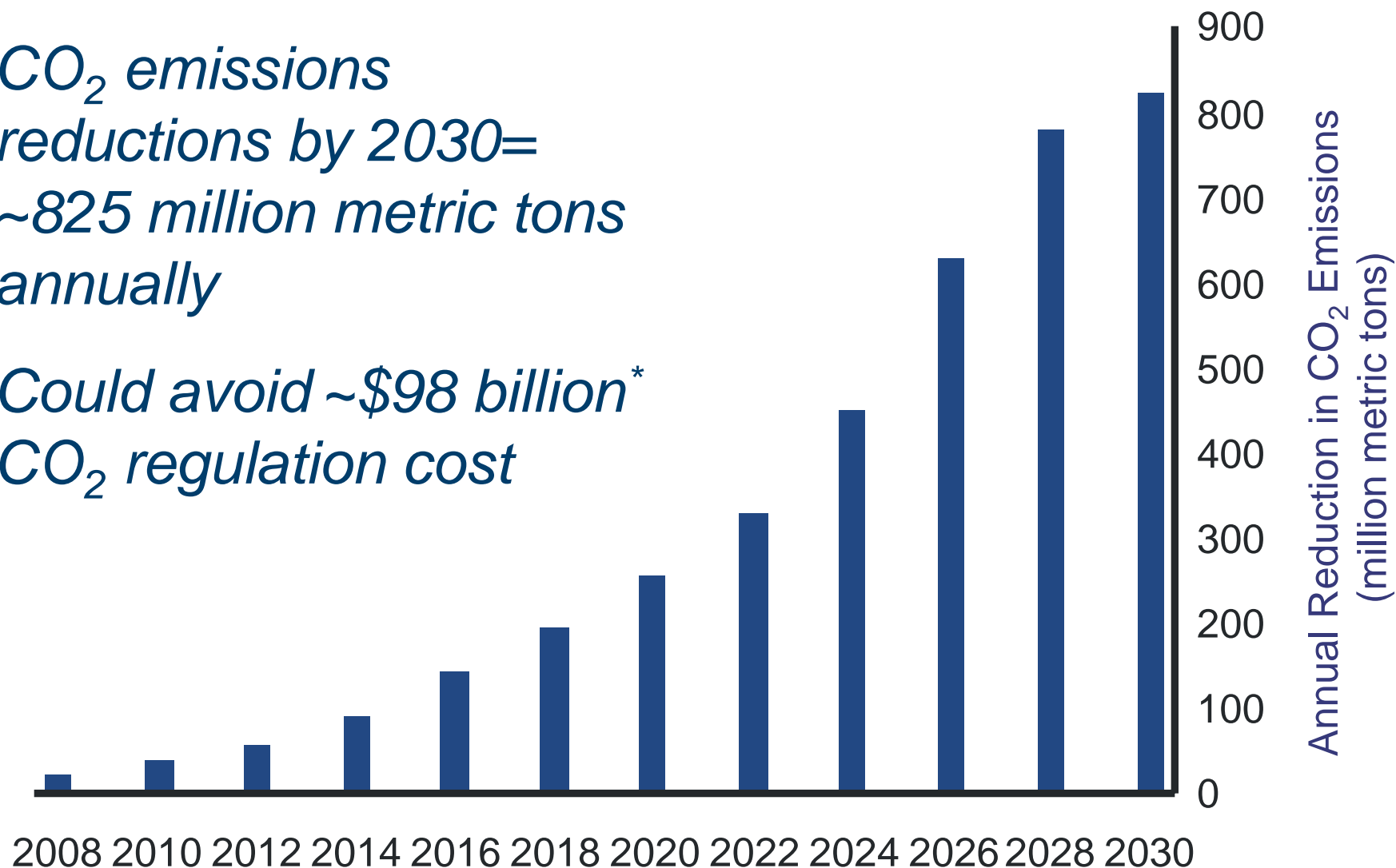




# Annual CO<sub>2</sub> Emissions Reductions

*CO<sub>2</sub> emissions reductions by 2030= ~825 million metric tons annually*

*Could avoid ~\$98 billion\* CO<sub>2</sub> regulation cost*



■ Annual Reductions





# Wind Power Avoids Other Negative Impacts

- ✦ Wind power avoids the negative impacts of generated fossil fuels:
  - Air emissions of mercury or other heavy metals
  - Emissions from extracting and transporting fuels
  - Lake and streambed acidification
  - Production of toxic solid wastes, ash, or slurry



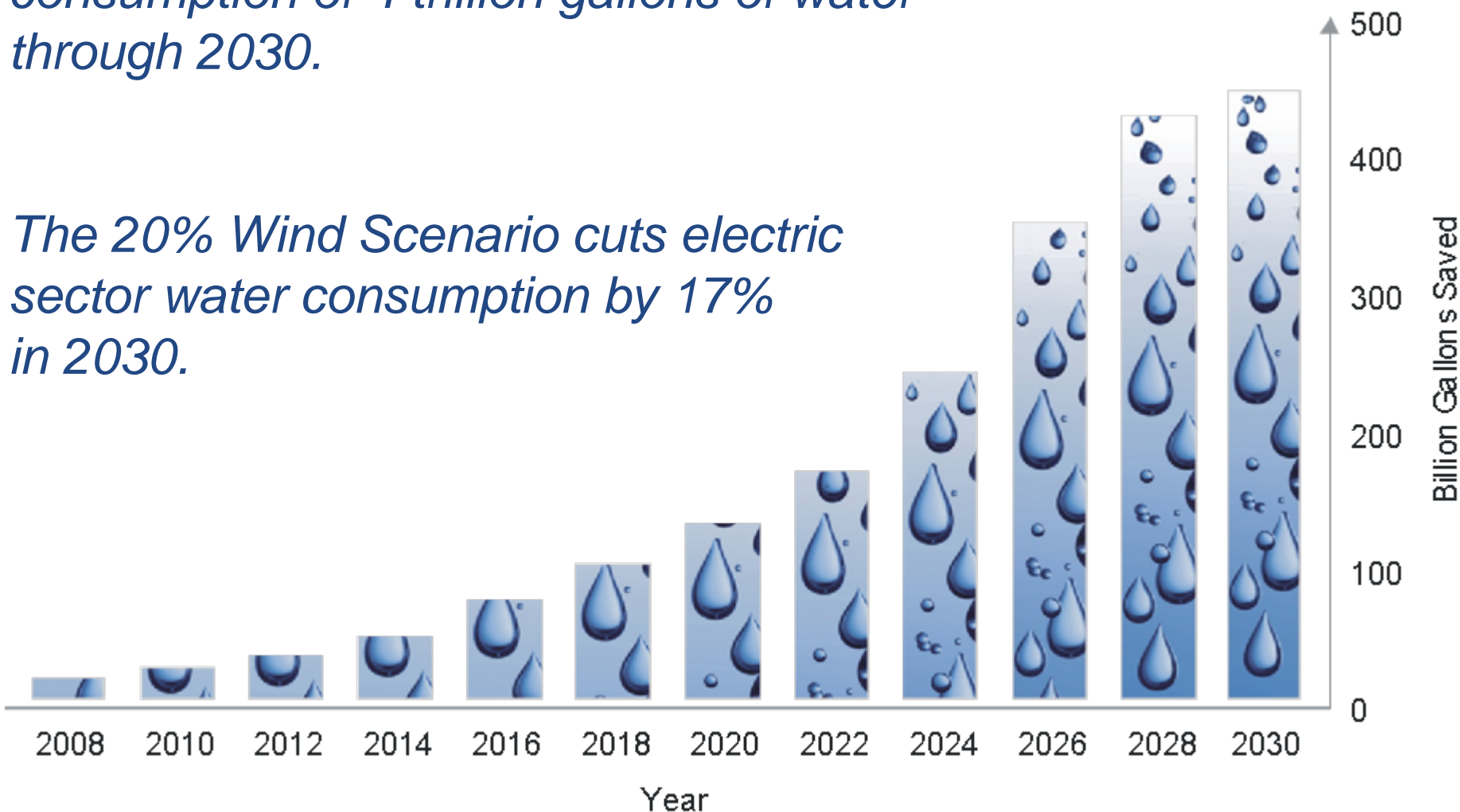
Photo courtesy: NREL



# Significant Water Use Savings

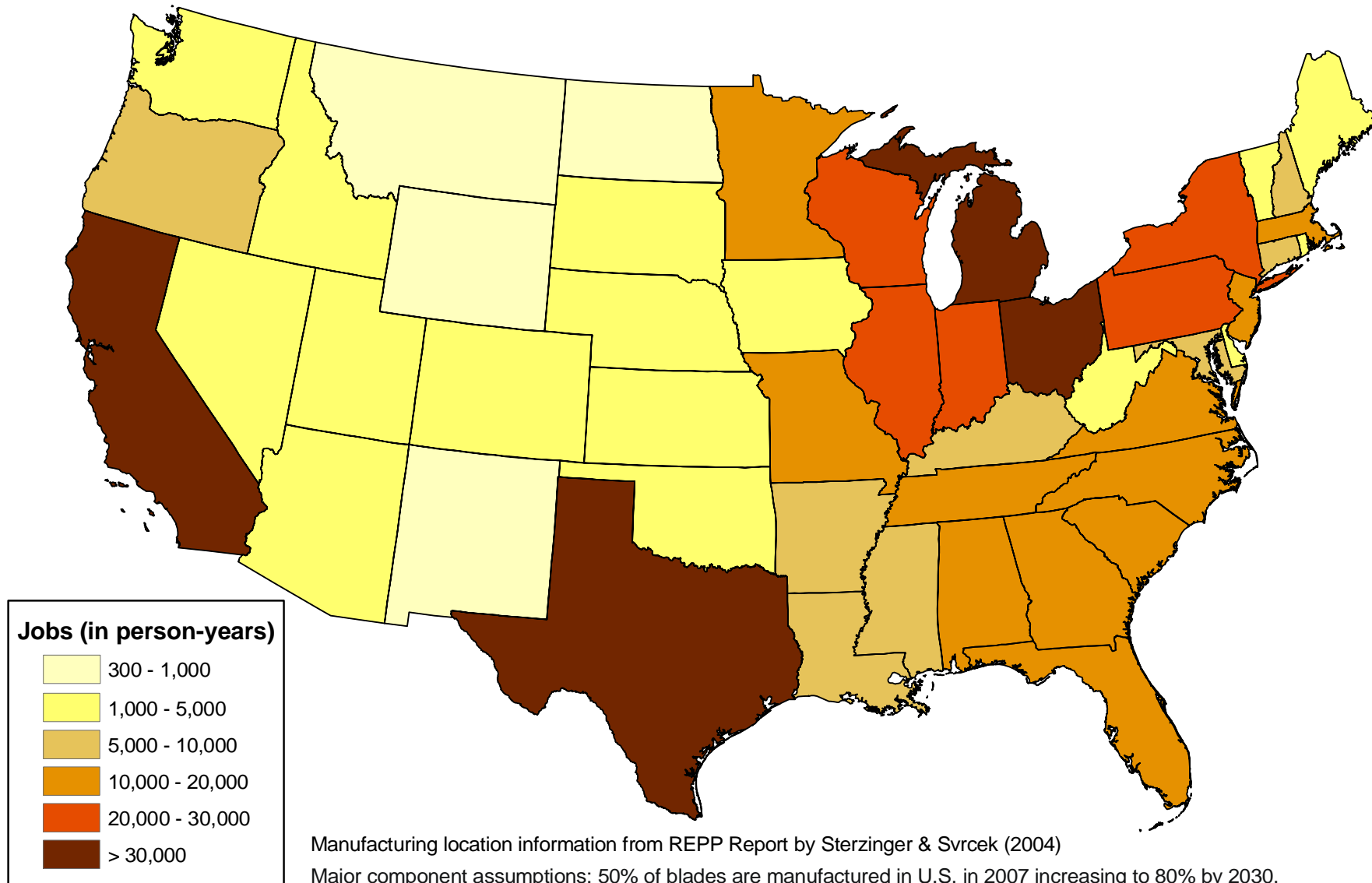
*Cumulatively, the 20% Wind Scenario would avoid the consumption of 4 trillion gallons of water through 2030.*

*The 20% Wind Scenario cuts electric sector water consumption by 17% in 2030.*





# Manufacturing Jobs Supported by State

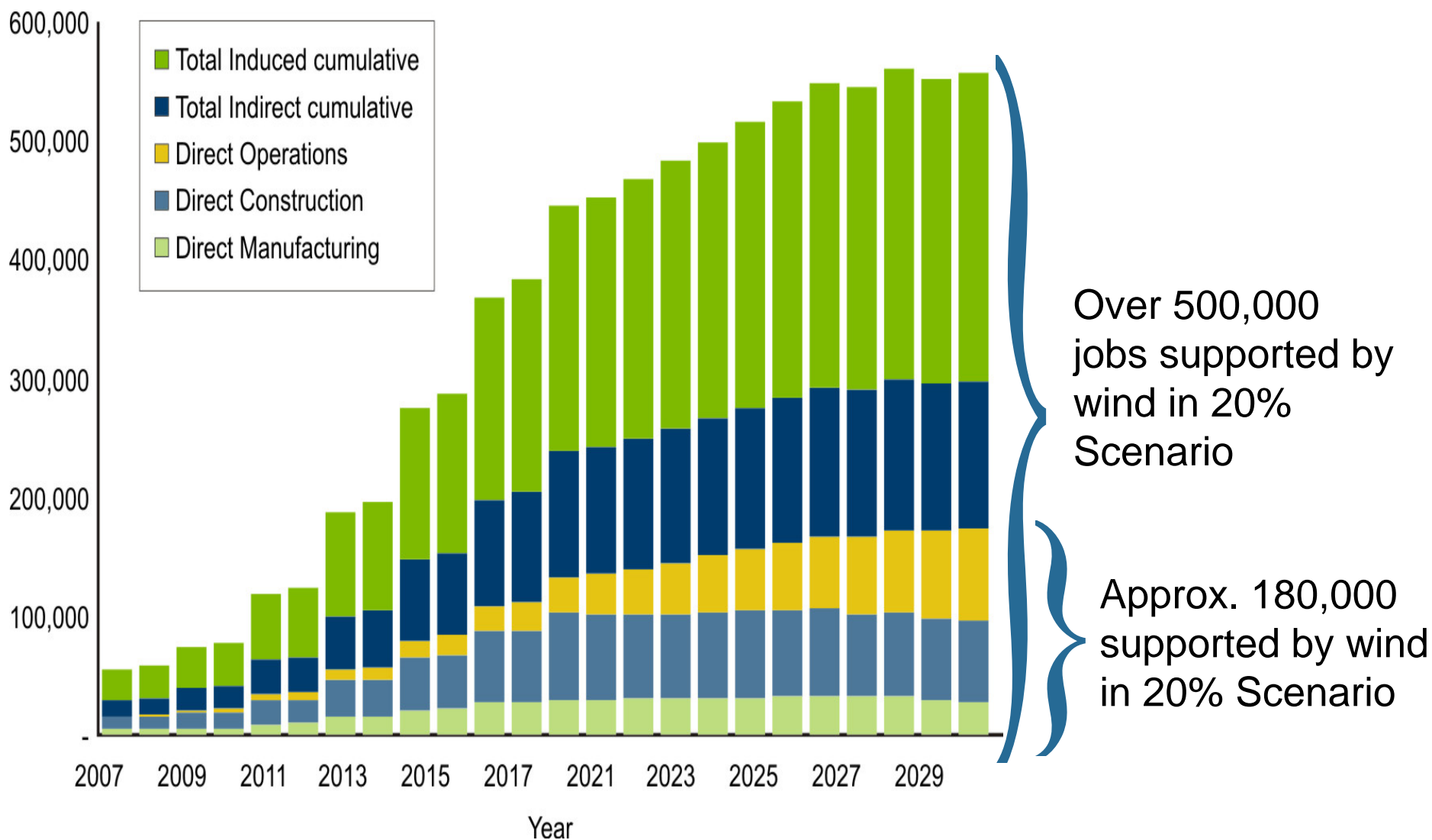


Manufacturing location information from REPP Report by Sterzinger & Svrcek (2004)

Major component assumptions: 50% of blades are manufactured in U.S. in 2007 increasing to 80% by 2030, 26% of towers are from the U.S. in 2007 increasing to 50% by 2030 and 20% of turbines are made in the U.S. increasing to 42% by 2030.



# Jobs Supported by 20% Scenario



# Challenges to Achieving the 20% Wind Scenario



# Transmission

- ✦ Enhancement of electrical transmission system required in all electricity-growth scenarios
- ✦ Transmission is needed to:
  - Relieve congestion in existing system
  - Improve system reliability for all customers
  - Increase access to lower-cost energy
  - Access new and remote generation resources
- ✦ Wind requires more transmission than some other options as best winds are often in remote locations



Photo courtesy: NREL





# Examples of Technology Improvements in Support of 20% Scenario

## ✦ Increase capacity factors

- Pursue larger rotors and taller towers
- Continue improvements to blades, rotors, drive-train components and controls
- Enhance reliability of major components

## ✦ Reduce capital costs

- Reduce aerodynamic and mechanical loads through advanced blade and rotor concepts
- Reduce turbine weight through judicious use of newer, high-strength materials
- Improve component manufacturability and manufacturing processes

## ✦ Mitigate risks

- Evaluate performance to enable early identification of issues
- Track O&M needs to enhance experience base for turbines and components
- Conduct testing and certification activities



# Project Siting: Concerns

## ✦ Project siting often raises local concerns about:

- Visual impacts
- Property value impacts
- Impacts on local wildlife/habitats
- Turbine or rotor noise
- Land use



Photo courtesy: US Fish and Wildlife

- ✦ Wind generation is responsible for 0.003% of human-caused avian mortality (National Research Council, 2007)
- ✦ Bat mortality has been higher than expected
- ✦ No site or cumulative impacts on bird or bat populations have been demonstrated, to date

# Summary





# 20% Wind Scenario

- ✦ Explores one scenario for reaching 20% wind energy by 2030 and contrasts it to a scenario in which no new U.S. wind power capacity is installed
- ✦ Is not a prediction, but an analysis based on one scenario
- ✦ Critically examines wind's roles in energy security, economic prosperity and environmental sustainability
- ✦ Would require about 300 GW (300,000 MW) of wind generation- an increase of about 290 GW in wind installations between 2007 to 2030
- ✦ Shows that affordable, accessible wind resources available across the nation



# Summary: **Costs** & Benefits

Incremental direct cost to society	<b>\$43 billion</b> <b>50 cents/month/ household</b>
Reduction in emissions of greenhouse gasses and avoided carbon regulation costs	825 million tons of CO <sub>2</sub> \$50 to \$145 billion
Reduction in water consumption	8% through 2030 17% in 2030
Jobs supported and other economic benefits	500,000 total with 150,000 direct jobs \$2 billion in local annual revenues
Reduction in nationwide natural gas use and likely savings for all gas consumers	11% \$86-214 billion

# **AWEA Activities to Support 20% Wind Energy by 2030**

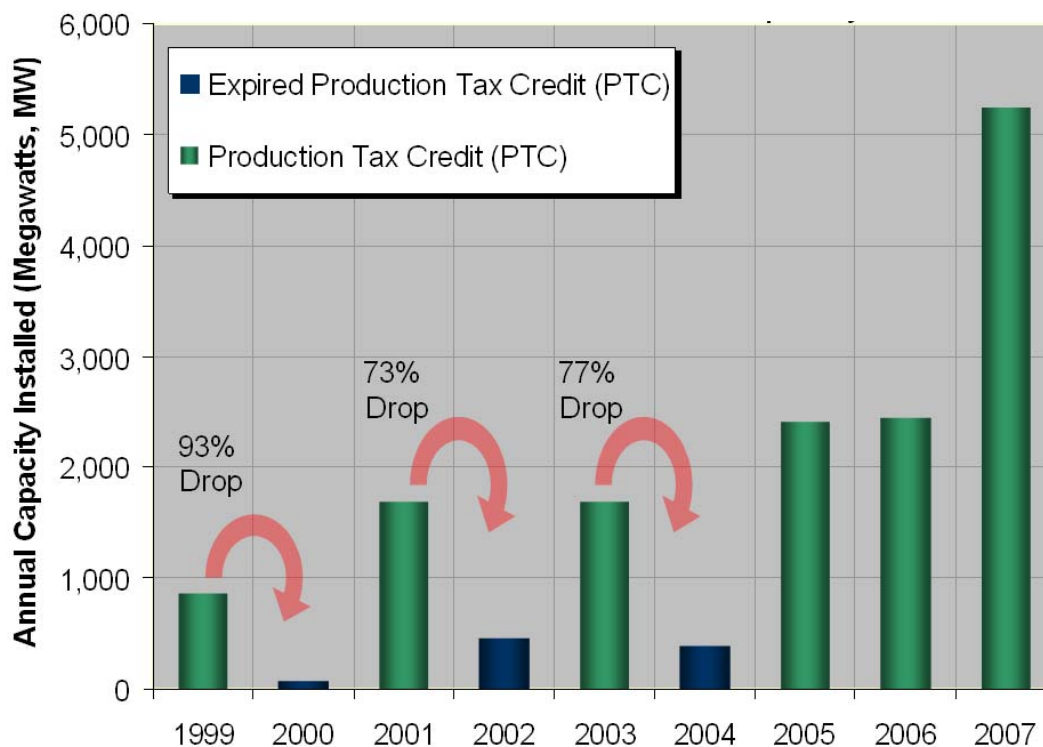
[www.awea.org](http://www.awea.org)

**awea** american wind  
energy association





- ◆ Primary federal wind energy incentive
- ◆ Set to expire December 31, 2008
- ◆ Stability is key to wind industry growth



# awea

american wind  
energy association



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## A DIVERSE COALITION CALLS ON CONGRESS TO QUICKLY PASS BIPARTISAN LEGISLATION TO EXTEND CLEAN ENERGY TAX INCENTIVES

These incentives promote clean renewable energy and energy efficiency in homes, office buildings, appliances and other consumer products and will save consumers money on energy bills.

EVERY DAY THAT PASSES WITHOUT AN EXTENSION  
RISKS A TOLL ON AMERICAN JOBS AND CLEAN  
ENERGY INVESTMENT IN OUR COUNTRY.

JP Morgan Chase • Johnson Matthey • League of Conservation Voters • LM Glasfiber, Inc. • LOGAN Energy • Mesa Power LP • Mitsubishi Electric • Mortensen Construction • MSE Power Systems Inc. • National Association of Home Builders • National Association of State Energy Officials • National Electrical Manufacturers Association • National Grid • National Rural Electric Cooperative Association • National Venture Capital Association • National Wildlife Federation • Natural Resources Defense Council • Noble Environmental Power • Northeast Public Power Association • NorthWestern Energy • North American Insulation Manufacturers • OGE Energy Corporation • Owens Corning • Pacific Winds LLC • Pepco Holdings, Inc. • PG&E Corporation • Pinnacle West Capital Corporation • PNM Resources, Inc. • PPG Industries

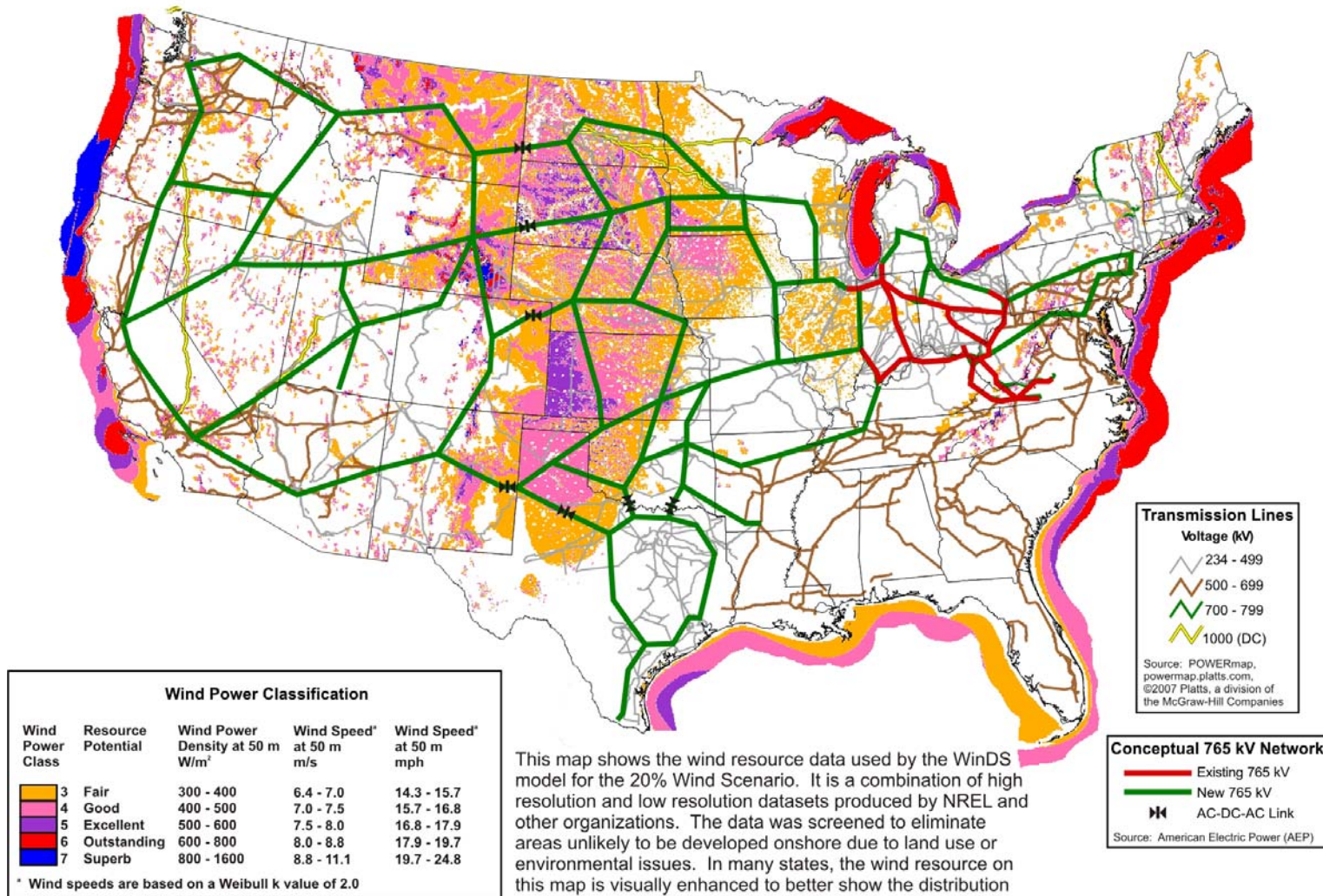
• PPL Corporation • Plug Power Inc. • Portland General Electric • PSEG • Puget Sound Energy • Regrid Power • ReliOn • Renewable Energy Systems Americas Inc. • Sanyo • Sempria Energy • Siemens • Sierra Club • Sierra Pacific Resources • Signal Wind Energy • Solar Energy Industries Association • SunPower Corporation • Suzlon Wind Energy Corporation • TechNet • The Dow Chemical Company • The Empire District Electric Company • The Federal Performance Contracting Coalition • The Real Estate Roundtable • TPI Composites, Inc. • Trade Wind Energy, LLC • Trinity Structural Towers, Inc. • Union of Concerned Scientists • UniSource Energy Corporation • United Steelworkers • U.S. Fuel Cell Council • UTC Power • Vestas American Wind Technology • Vote Solar • Westar Energy, Inc. • Whirlpool Corporation • Wind Capital Group, LLC • WindLogics Inc. • Wisconsin Power and Light • Xcel Energy Inc.

- ◆ National Renewable Electricity Standard
- ◆ Would create a stable policy environment for investment in manufacturing and transmission infrastructure
- ◆ Would save American consumers over \$100 billion in lower electricity and natural gas prices *(Wood Mackenzie, March 2007)*
- ◆ 26 states and D.C. have state-wide renewable electricity standards in place
- ◆ National RES legislation has passed U.S. House and Senate separately, but has not passed into law

- ◆ U.S. faces a lack of adequate transmission infrastructure and a balkanized operating structure
- ◆ Congress should direct FERC, DOE, and federal utilities to use their existing authority to expand regional infrastructure and regional power pools
- ◆ Good starting points for federal legislation:
  - Rep. Inslee and Rep. Blumenauer's Rural Clean Energy Superhighways Act (H.R. 4059)
  - Sen. Reid's Clean Renewable Energy and Economic Development Act (S. 2076)
  - Sen. Thune's Clean Energy Corridors amendment



## AEP's Conceptual Transmission Plan to Accommodate 400 GW of Wind Energy



- ◆ Legislation to curb greenhouse gas emissions should:
  - encourage renewable energy in the early years as well as long term
  - send a strong and direct price signal
  - give direct financial recognition to renewable energy emission reductions
  - use auction revenues to support transmission infrastructure, renewable energy manufacturing, green jobs



- ◆ There is currently no federal incentive for residential scale wind turbines (100 kW or less)
- ◆ A 30% federal small wind investment tax credit (ITC) incentive would:
  - greatly drive up production volumes
  - lower costs
  - help this U.S.-dominated industry grow 40-50% per year

- ◆ Greater funding for wind energy research and development will decrease costs and improve performance
- ◆ Raise annual DOE wind program R&D budget from \$50 million to \$120 million

- ◆ One of AWEA major strategic objectives in 2008 is to strengthen the wind energy industry's Supply Chain
- ◆ AWEA Supply Chain initiatives:
  - Market analysis and barrier evaluation
  - Outreach to states
  - Workshops (December 2008: Cleveland, OH)
  - Key policy and regulatory issues (e.g., transportation)
  - Develop marketplace
  - Examine global supply chain implications
- ◆ Tracking new manufacturing facilities, jobs creation, and economic development aspects of wind energy industry

- ◆ Federal government should consult with wind industry and non-governmental organizations to research methods of minimizing wind turbine impacts on wildlife
- ◆ Base federal guidelines on best available science
- ◆ Scale up permitting and review capabilities at federal agencies

- ◆ Policies with near-term impacts:
  - Stable production tax incentive (PTC)
  - Small wind investment tax incentive (ITC)
  - Fair and efficient siting
- ◆ Policies with mid-term impacts:
  - National renewable electricity standard (RES)
  - Policies to promote renewable energy transmission
  - Research and development (R&D) funding
- ◆ Policies with long-term impacts:
  - Effective carbon regulation

- ◆ To read more on or to download the “20% Wind Energy by 2030” report from the U.S. Department of Energy, go to : [www.20percentwind.org](http://www.20percentwind.org)
- ◆ To contact me:
  - Jeff Anthony [janthony@awea.org](mailto:janthony@awea.org)
- ◆ AWEA may conduct more in-depth webcasts this Fall on specific topics covered today – let me know if you have an interest in any particular topic for a webcast.
- ◆ Your Questions ?





# Thank You for Your Participation

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